



The Earth Science
DIGEST

JANUARY 1947

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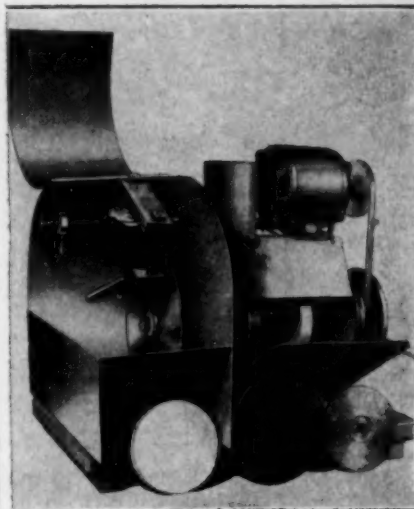
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Letters to the Editor

Gentlemen:

We have today received an order from one of our most important technical libraries for a subscription to the **Earth Science Digest**. We would like to enter this for three years. If possible, we would like to start with Vol. I, No. 1.

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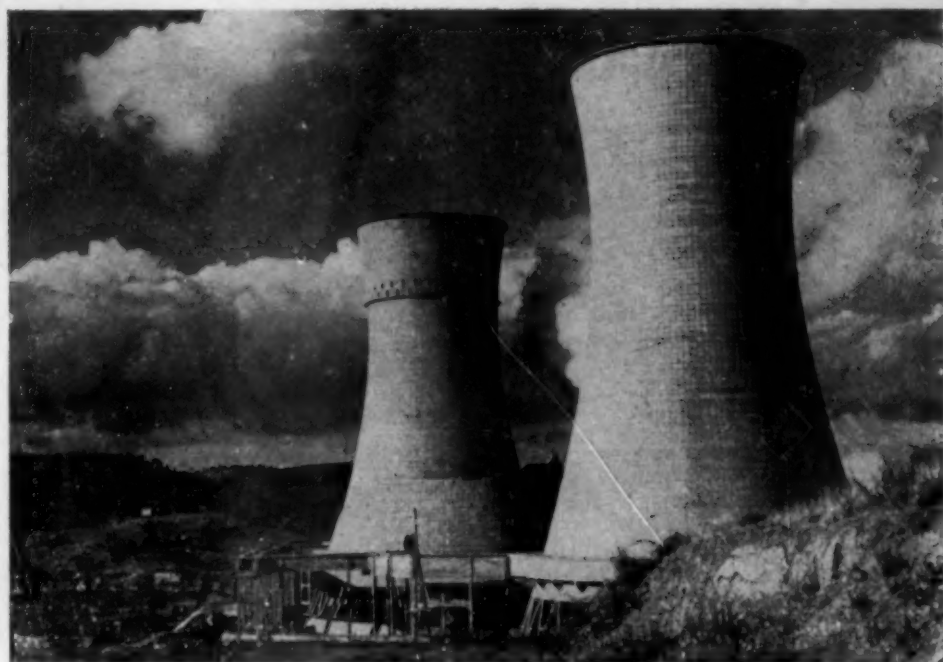
Please Mention Earth Science Digest

Cover Photo

In this issue is an article by Prof. W. D. Keller of the University of Missouri about a natural steam deposit in Italy. The photograph on the cover shows one of the steam wells present at this deposit blowing live steam at 4 atmospheres pressure. The noise accompanying the blowoff was deafening and persons in the foreground of the photo may be observed holding their hands over their ears.

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Two Condenser Towers at Larderello and Remains of a Th'rd Destroyed by Bombing

An Ore Deposit of Natural Steam

By W. D. Keller

During this cold winter weather when fuel is scarce and high priced, when one has to get out in the cold morning to tend the furnace, or depend upon the janitor not to let you (or your thermometer) down, how would like to be connected to a steam well that taps an almost inexhaustible supply of super-heated steam coming from the bosom of old Mother Earth herself? Moreover, that well would produce enough steam to run a turbine-generator set which would generate electrical power for your home appliances, for heat in distant towns, and to run electric locomotives on a major railroad line. And besides furnishing all this thermal energy, the steam would be condensed, and perhaps a dozen chemical products, like boric acid, borax, dry ice, etc.,

would be produced from the originally vaporous emanation. Here would be a truly valuable vaporous ore deposit.

But do not think for a minute that this is a Jules Verne fiction story or a Utopian, wishful thinking, one million calorie and ten kilowatt a week pension plan—it is a practical, commercial, proven occurrence and development. You probably have not heard about the locality because it is not in the United States, Iceland, or New Zealand, all of which have the more or less well publicized geyser and hot spring localities. Instead, this largest source of natural steam, and the large commercial development of it for some twenty to thirty years, occurs in a "have not" nation, Italy. About 40 miles south of Leghorn



The Chemical plant at Larderello

and about 20 miles inland from the Tyrrhenian sea, also about 15 miles south of the city of Volterra, in Tuscany, occur seven large groups of natural hot steam vents and drilled wells which are distributed over an elliptical area of about 100 square miles. See Figure 1.

Major development of power and chemical industry is at the Larderello group and the geologic occurrence is commonly spoken of as the "Larderello steam."

The natural steam vents or blow holes, which the Italians call "soffione", have been known since the thirteenth century when they were thought to be dangerous manifestations of the power of the devil and were diligently avoided. One need not stretch his imagination far, in terms of the lack of chemical and geological knowledge of the thirteenth century, to interpret the chemically active steam which his-

ses and spurts explosively as emanations from a portion of nearby hell.

After about 1750, however, a beginning was made of the study of geology of the region, and in 1777, a chemist isolated boric acid from the water issuing with the natural steam. In 1827, a French exile, Francesco Larderel (from whom Larderello was named) conceived a practical method of using the steam to concentrate commercially the boric acid and started a paying chemical industry. In 1904, the steam was first used to feed a small steam engine which drove a dynamo generating current to light a few lamps. By 1941, over 100,000 kilowatts of electrical energy were being produced in several "supercentrali" power plants (which were about 90% destroyed by the war). This power served most of the consumers of electricity in Tuscany



General View of the Larderello Chemical Plants

and supplied the major need for the electrified railways between Leghorn and Rome. Important engineering problems had to be solved in utilizing the steam and condensing the engine exhaust because of the presence of chemicals and other gases in the steam. Much chemical research has been done on the extraction, purification, and recombination of the chemical "impurities" in the steam, and a monumental treatise of over 650 pages have been written and compiled by Professor Nasini on this boracic industry.

The steam vents (*soffioni*), the hot springs and bubbling puddles (*lagoni*), and the drilled wells of notable vigor (*soffinissimi*) mainly Eocene to Miocene in age.

The natural vents are located along deep faults or more surficial fractures. Wells are drilled in the productive areas most commonly to a depth of about 250 meters, and it was reported that in the 12 years preceding 1936 total drilling was about 40,000 meters in length. This

will give some idea of the magnitude of the development. Several chapters of private publications on the Larderello region are devoted to technical problems connected with drilling wells, using both churn and rotary drills, into steaming hot rocks with always the possibility of inviting a disastrous scald-and burning explosion. Although many holes were drilled to tap the emanations no recognizable reduction in steam production had occurred. Plans had been made before the war to expand the drilling and production program.

Although most wells deliver steam at pressures from 2 to 5 atmospheres, one well was rated at 14 atmospheres with the valve still partly open. Probably the pressure on the closed well would have been higher but it was considered unsafe to close it off entirely. The photograph on the front cover shows a well blowing at 4 atmospheres pressure. The noise from the large volume of escaping steam was deafen-

ing, and the GIs (American Army students from the American Army University at Florence, Italy where the writer was an instructor) seen in the picture were warned to protect their hearing by holding their hands over their ears.

Representative data of a well completed on 31 March 1936 are given below:

Diameter	19 inches
Depth	876 feet
Pressure	63.5 lbs. per sq. in.
Temperature	410° Fahr.
Yield	485,000 lbs. vapor per hr.

The chemical composition of the vapor is very constant throughout the area and has been so for many years. This is significant for it indicates a large, uniform source for the vapor and points to the presence of a large intrusive igneous body solidifying below and giving off its volatiles. A chemical analysis of the vapor is given below:

Grams per kilogram of natural vapor.

H ₂ O	945.87
CO ₂	51.46
H ₂ S	0.86
H ₃ BO ₃	0.5
N ₂	0.46
CH ₄	0.34
H ₂	0.05
NH ₃	0.1

He, Ar, etc 1 cc. per kg. (with N₂)

In practice, the boric acid is removed first, and in later stages the CO₂, NH₃, H₂S, etc., are recovered. See Figure 2. They may be purified and sold, or be recombined to produce a variety of other chemical compounds. For instance, before 1938, over 6000 tons of the following chemicals were produced in one year:

- Boric acid
- Borax
- Carbon dioxide and "dry ice"
- Ammonia, liquid
- Sodium perborate
- Ammonium bicarbonate

- Ammonium carbonate
- Ammonium chloride
- Ammonium sulphate

During the war, destruction by allied bombing and German demolition was about 90%. It will take a long time for crippled Italy to restore to full efficiency this world-leading development of a natural steam ore. See Figure 3.

When one visits this very interesting occurrence he can not help but concur with Italian scientists who have wondered if natural steam might not be tapped elsewhere on this globe.? Some drilling has been made at "the Geysers" region in California to test the possibilities there, but presumably the quantity produced did not justify additional development. The steam at Yellowstone National Park is protected (as it should be) within the Park boundaries. Natural hot water and steam have been utilized on a smaller scale in Iceland and at regions other than at Lardarello, but presumably really large scale drilling has not been resorted to in extensive efforts to tap the subsurface heat energy of the earth. Does not this possibility merit additional attention, particularly in certain critical regions?

Regarding the geological explanation of the source of Lardarello steam and chemicals, there is little doubt that it is magmatic, and that it comes from a huge, probably batholithic, solidifying body beneath, which as it "freezes" to igneous rock, expels the volatiles formerly held in solution. Evidence for this belief lies in the great volume of steam not affected by extensive drilling over several centuries, its superheat, the abundance and constancy of boric acid and other mineralized chemicals in the emanations, and the wide-spread (over 100 square miles) occurrence of the steam vents.

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Skagway, a "shadow" of the Town as it Was in Gold Rush Days

Alaska Gold Trails of Ninety-Eight

By Victor Shaw

Looking back it seems incredible that but fifty years have passed since placer gold was found on Klondike River, Yukon Territory. That river of course is in Canada, but the famous stampede led also to discoveries of many new gold fields in northern Alaska, since it proved to be richly mineralized from Hyder to Barrow and Forty to Nome. And yet thirty years prior to 1898 Alaska was practically unknown country.

True, the Russians mapped some of it in their century and a half of fur hunting, and even found some gold. However their mapping was sketchy and they didn't bother with gold since sea otter and fur seal were plentiful and more easily obtained. Thus, when our flag was raised at Sitka on October 18, 1867, we knew little and cared less about a frozen wilderness, which at that time was dubbed "Seward's Folly."

As a nation we were not gold-conscious until Marshall found the yellow grains at Sutter's Mill, California, in 1848. Then for two score years we were too busy trekking west and settling there, to heed similar news from elsewhere. Besides, we were digging gold in sunny California. At any rate, our complacency was undisturbed till the A-bomb of 1897 blasted it to flinders.

Adventurous miners had for several years before 1897 been washing the yellow stuff from creeks on a stream forty miles below Dawson, which in 1886 had yielded a quarter million in bullion. Some still were doing all right, but many others who were not sluicing out enough for bean money, had prospected farther up the Yukon to where on Bonanza Creek, a branch of the Klondike River, Geo. Cormack on August 21, 1896 made a marvelous-

ly rich strike. When the word reached Forty-Mile, most of the miners packed up and hurried to the new field, where every creek was said to be paved with untold wealth. News of the new strike drifted down to the Cassiar and, deserting everything, those miners broke all travel records getting to the Klondike River.

During the winter of 1896-97 unconfirmed reports of the new gold field reached Seattle, where it hardly caused a ripple; though a few adventurers sailed north on the steamer, *Mexico*, landing at Dyea on March 28th, hoping to hit the Yukon before the spring break-up. But, out of this party, only four reached Dawson on May 28th and there is no record of what happened to the remainder.

Then, July 17, 1897, came the news that "a ton of gold" had arrived in Seattle on the steamer *Portland*, although in Troy ounces the amount was far less. At any rate, thus headlined in the *Post Intelligencer*, with the added statement that this was only a portion of the '96 cleanup, the stirring news was wired across the nation and over the world. Literally thousands of men and women of all types swarmed into Seattle headed for this stupendous new El Dorado.

It has been rightly called "a stampede"; a vast river of human eattle, which flowed by thousands into Seattle, Tacoma, and Vancouver, B. C., all of them clamoring for steamer passage north to the fabulous new diggings. They were of every type and class, from beardless youths to limping oldsters; merchants, clerks, bookkeepers, janitors, skirted school teachers and the usual shoals of gold digger ladies; to say nothing of saloon men, gamblers, and riffraff, who always flock in to grab a share of all easy money.

Overnight, Seattle became a mad

house. Its steep, narrow streets were jammed with jostling throngs. Every store on Front and First streets was packed with people. All the piers and steamship offices were crowded by endless streams of wild-eyed humanity, shoving and cursing to be first in line for needed supplies and accommodations.

Transportation northbound was sorely over-taxed, so that every ship built new berths in forecastles and even in the holds, and passengers berthed on deck, and in life boats on the davits. Sailing craft were at a premium. Outlawed wrecks were patched and painted and loaded to their bridges with gold seekers and their outfits.

In town, the gambling district across the city "deadline" held high carnival and cash flowed like water. There was fighting and gunplay each night, and every morning courts were packed.

Hordes of Klondikers eager to increase their grubstakes by gambling were stripped and left stranded, bereft of all hope of gaining a fortune. Many gamblers went north to ply their trade, but the "wise guys" stayed in town to "get 'em going and coming". Seattle was a sweet spot, with well heeled thousands going north and those bulging pokes arriving on every steamer.

And this is what the writer found when he hit Seattle in February, 1898, having missed the hectic summer of 1897 while in Baffinland, (see *Earth Science Digest*, August, 1946). News of this unprecedented rush to Alaska came on reaching Boston in late September of 1897; but, though memory of ensuing events is vivid, no particular excitement at the news can be recalled.

However, during the winter of 1896-97, moved by the Cormack find on the Yukon, we had dug up in the local library, Lieut. Schwat-

ka's "ALONG ALASKA'S GREAT RIVER", and had been intrigued by the mention of placer gold found to exist from Pelly River to Circle City.

In fact, we talked with a hunting companion about making a prospecting trip up the Yukon, going by way of St. Michaels, and planned to start as soon as necessary grub-stake funds could be secured. Thus, when a member of our Baffinland expedition came in January, 1893, and proposed that we go with him to the Klondike, we accepted with enthusiasm, since he had the funds for a year of prospecting.

En route west in February by train, we crossed the Rockies through snow piled above the car roofs; then dropped down the western slope into Spokane, where we had our first insight into what the big hegira north really meant. Our train halted so long that we got out to see what was wrong. We found a confusion of cursing train hands, a yelping melee of dogs of all kinds, and laughing townsmen, while train men were throwing the dogs into a box car as fast as they could catch them.

"What goes on?" we asked an amused bystander.

"Order came in last week to rush a hundred dogs to Seattle."

"Sledge dogs?" we inquired, chuckling. "Those mongrel mutts?"

"Wire just said 'dogs'. The whole town's been huntin' 'em the past week an' there they are — worth one grand, delivered."

And, just dogs was right. They were of all kinds, big and little,

setters, shepherds, mastiffs, hounds, even terriers, with many of simon-pure mongrel strain. And we wondered, as we returned to the car, if the seller would have any trouble collecting \$10 a head. Maybe the buyer didn't know the sort of dogs needed for sledging.

On reaching the chaotic capital city, the carload of mongrels was run onto a siding and the dogs turned loose in the streets, having been refused by the buyer. This, we learned, was not the first time it had happened, with the same result. In consequence, it was hard to sleep nights with the hungry brutes howling and fighting over garbage around hotels Seattle and Butler.

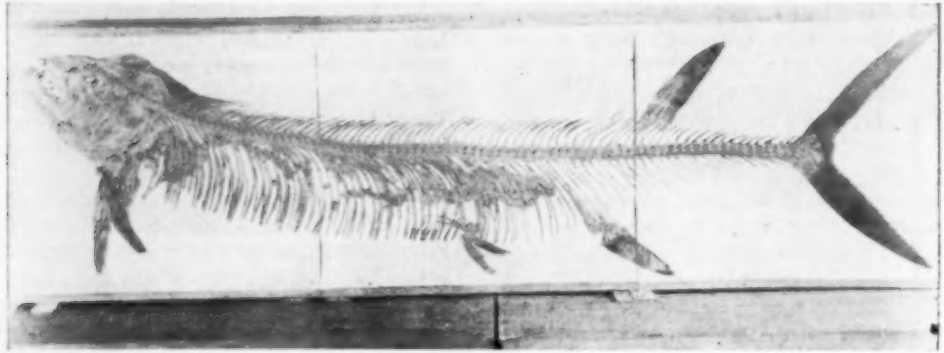
Daytimes, we strolled the waterfront taking in scenes we'd never seen before, nor since. One of these was a magnificent team of male-mutes, thick pelted and curly tailed that paraded the streets dragging a battered basket sledge placarded: "OUTFIT COMPLETELY WITH SEATTLE HARDWARE COMPANY", also giving the street and number below.

We first visited the shipping offices, for sailing schedules and costs of fares to various northern ports. We hadn't wired for a berth reservation, since we hadn't yet decided where to go; but it didn't matter, for everything was sold out solid for weeks, in fact, many berths were reserved for months in advance. At the big Seattle Hardware, we found counters piled high with every conceivable article needed on northern trails, with many that were not. Prices were high.

One incident gives a clue to general procedure: a man and a woman, well dressed of city type, were being sold — of all things — an expensive full-length sealskin coat for the lady's trail work. A gar-

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Porthetus Molossus with a seven foot fish in its stomach

A 15 Foot Kansas Fish

Internationally known fossil hunter, George Sternberg of Hays, Kansas recently made one of the most unusual discoveries of his career. While hunting in the Niobrara Cretaceous chalk beds of western Kansas, he found the skeleton of a 15 foot long *Porthetus Molossus* with a 7 foot fish intact in its stomach. When Sternberg first discovered the fish only the extreme portion of the tail was in sight. The rest of the fish was covered by an overburden of fifteen feet of rock. After a brief survey it was determined the only way the specimen could be collected would be to remove the rock overburden in its entirety. Sternberg knew this would be a formidable task but within days he had moved his field camp to the spot and work was begun. The overburden was carefully "lifted" out and the complete skeleton was exposed. The fish was so large that it was necessary to remove it in three sections. Iron frames were first placed over the specimens and were then filled with plaster. The resulting slab was then separated into three sections and removed to Mr. Sternberg's laboratory for preparation. The fish was one of the most perfectly preserved specimens to come

out of Kansas. Although it was 150,000,000 years old, not a bone was broken and there was very little, if any, distortion. Three months were required to completely dislodge the fish and mount it. The specimen is now in the Colorado Museum of Natural History at Denver where it is being prepared for wall mounting.



Quarry where 15 ft. *Porthetus* was found



The Hays College Museum with a 30 1/2 foot mosasaur in the background

During the Cretaceous period the Kansas seas were inhabited by many strange creatures. Giant clams sometimes measuring several feet across lived on the sea bottom. Mosasaurs, giant sea reptiles, swam through the shallow seas.

Plesiosaurs, a turtle-like animal measuring as much as forty feet in length clumsily made their way about, seizing fish and other prey.

Their remains, while rare, are occasionally found and excavated.

To the fossil collector, the Niobrara chalk beds present a fertile field. The chalk itself is fossil, being composed of the skeletons of countless trillions of minute one celled animals called foraminifers which, under the microscope, present an amazing diversity of forms.

Scattered through the chalk are found isolated fish vertebra and teeth, reptile vertebra and teeth, and other vertebrate remains. On rare occasions a complete skeleton is found. The amateur shouldn't attempt to collect complete vertebrate material. Much painstaking work and time are required to collect complete fossil vertebrates and few amateurs are equipped with

the knowledge and tools for such activity. Fossil bones are usually very fragile and must be handled with the utmost care. One slip and a valuable link in the chain of prehistoric knowledge may be broken into a thousand pieces. If a complete skeleton is found the best procedure is for the finder to notify his state university. The university will, in all probability, send out a field unit to collect the specimen. If for any reason they don't wish to collect the specimen then, in the opinion of the writer, the finder has every right to attempt to collect his discovery.

Collectors who pass through Hays, Kansas should make it a point to stop in Ft. Hays College to see the excellent display of fossils in the college's museum. Mr. Sternberg is curator of the museum and under his guidance a display has been worked out that rivals some of the exhibits in larger museums.

During the early part of his career, Mr. Sternberg specialized in collecting vertebrate fossils from the Paleocene to the Pleistocene. For the past few summers he has collected fossils for the American Museum of Natural History.

Quicksilver in the Big Bend Region of Texas

Perhaps the most desolate mining district in the United States is the quicksilver district lying near Terlingua, Texas. Cinnabar deposits were first noticed by the Comanche Indians who ground the cinnabar for use in war paints.

Mexicans were the first to attempt to mine the valuable ore. One thousand flasks were removed in 1899 and by 1910 over 50,000 flasks of mercury had been removed. Roasting ovens had been installed and production boomed until the surface deposits were worked out. In spite of the low cost of labor the mines relaxed into a period of inactivity until the first world war broke out. Demand for fulminate of mercury for use in detonators caused a new flurry of activity. Full scale operations were resumed in the area and new prospects were opened. Mercury production reached a new high and held its gain until the end of the war.

Shortly after the discovery of the cinnabar deposits at Terlingua, Mr. H. W. Turner of the U. S. G. S. visited the region. His most interesting discovery was a new mineral of mercury occurring as yellow-green crystals in limestone pockets.

The mineral, an oxychloride of mercury, was called Terlinguaite after the town. Other rare mercury minerals discovered were Kleinite, Moseitite, Eglestonite, and Montroydite. These minerals seldom occur in other localities, hence they are a rare and valuable addition to any collection.

One of the difficulties encountered in mining at Terlingua is the lack of water. Rainfall averages less than eight inches a year. The nearest good water supply is the Rio Grande River which is some

twenty miles distant. Another problem is fuel for the roasting ovens. There is little or no vegetation in the area that would afford fuel. At one time the ovens were supplied with a low grade coal occurring in a nearby region. Due to the ruggedness of the terrain, transportation of the coal was costly and the price per ton was almost prohibitive.

The refined mercury had to be hauled some eighty-five miles to a point where it could be picked up and transported by railroad. These and other factors combined to discourage continued operation of the mines.

The abandoned mines and the area immediately surrounding them present a fertile collecting locality. In addition to the mercury minerals which may be found at Terlingua, good specimens of calcite, pyrite, etc. may be found. Fifty miles north of Terlingua, plume agate, banded agate and other quartz minerals occur. The agate deposits usually aren't available to collectors. Irrate ranchers have posted signs prohibiting rock collecting. Indiscriminate collectors damaged fences, gates, etc. until the ranchers in the region fairly seethed with indignation. Perhaps it is just as well the deposits are restricted. The roads in the Big Bend region are rough and treacherous. Accidents are common. The remains of wrecked autos are frequent sights on the road between Alpine and Terlingua. A recent visitor to Terlingua reported seeing four wrecked cars within the space of a mile!

In our November, 1946, issue in describing the cover photo which was the Santa Heleno Canyon, we

mentioned that the country immediately surrounding the Canyon was wild and that mountain lions and snakes were the most common inhabitants. Since then we have had a number of letters from readers who have visited the canyon and found no "mountain lions and snakes." Perhaps the most informative of these letters was one from P. L. Ricker, President of The Wild Flower Preservation Society.

We have printed excerpts from Mr. Ricker's letter below.

"Was glad to see the cover picture of the November issue. I shot this scene in color in the spring of 1941. Your description of the Canyon as being 100 miles from the nearest highway with mountain lions and snakes the principal inhabitants makes me smile a bit. I assume you have not been there. Perhaps it is well it wasn't a nicer description because it might start a flood of tourists down there in which case airplane and other searching expeditions might have to be organized to get them out, (minus their cars). Certainly the National Park Service does not want to indulge in such expeditions with their very limited staff and equipment at the Big Ben National Park, not for a few years anyway."

"From Terlingua to the canyon (about 20 miles) there are two roads. One is impassable most of the time and the other part of the time. At first the road just trails across the desert, then it dips and follows some of the Rio Grande flood plain forks. It crosses a number of these forks and often rises over sandy banks eight or ten feet high. The chances of getting stuck in the sand are excellent. 50% or better and there are quite a number of these crossings before reaching the Rio Grande. Occasionally there is a flash flood. A Geologi-

cal Survey man and his wife tried to make the trip a few months ago and got stuck in the sand late in the day. A flash flood came up. They just got to the top of the bank as it swept by taking their car a mile down, burying it in sand, and completely wrecking it. They had to walk eighteen miles to find someone to pull them out. The car was finally extricated, but worthless! I doubt very much if there will ever be a road to the canyon from Terlingua or elsewhere that is much better than at present. The Rio would wash it out immediately."

"As to mountain lions. Did anyone ever see a mountain lion in a desert? Even the Chisos Mountains do not have enough of the right kind of vegetation to make a good home for them. The vegetation is typically desert at least half way up, and not much better at the top."

"As to snakes. There are probably rattlers and others occasionally, but we could not find a one during our stay. There is very little chance that the casual tourist will be bothered by snakes.

Nevertheless, it would not be advisable for anyone to go anywhere in the sparsely settled areas of West Texas without keeping constantly in mind the possibility of snakes."

Ed Note - We would advise any of our readers who contemplate a visit to the canyon to see that their automobile insurance is in good order.

ORE DEPOSIT OF NATURAL STEAM

From page 6

Pneumatolysis is at work on a grand scale at this Tusean locality which all earth scientists should try to see when they visit the Italian peninsula.

ALASKA GOLD TRAILS OF '98

From page 9

ment more inadequate can hardly be imagined. The pay-off was, as we listened in, that the salesman himself knew no better and we wondered what sort of prospecting outfit he'd unload on them.

Similar tactics were in force everywhere. Street hawkers howled the merits of all kinds of gadgets, guaranteed to cook a meal for six in 30 minutes, to drill to bed-rock a foot-a-minute, goldpans proven to recover 90% flour gold, bags that slept warm on ice or snow. There were knock-down sluices and rockers for sale, and placer machines costing up to several thousand dollars. The entire city was on its toes, making hay while the sun shone.

Added to this, we made a point of meeting each ship from the north, and questioned arrivals concerning the sort of country they had encountered. We had already decided, after buying and studying a map, that by this time Dawson and the Klondike must already be badly over-populated, most of the ground staked and only poor claims to be open for sale. This meant our chance would be better in other areas outside the Klondike River, which further complicated selection of a definite destination.

We had in mind the Copper River country, but after querying several who had been there, so they said, we abandoned it as being too risky.

After ten days of interviewing, and of digging up such information as could be had at the Seattle Assay office and the Chamber of Commerce, we still were undecided about our objective. So we settled for a wait of a couple of months, when steamers might be available and less crowded, also northern weather perhaps more comfortable. We spent this period hunting and

fishing at Lake Crescent, in the Olympic Mts; an interlude we have never regretted.

Back at the Seattle Hotel, we met a tall presentable chap, in the lobby one evening, whose pockets were stuffed with milky quartz shot full of wires and flecks of red gold that looked about 18 fine.

Where did he get it? Oh, from one of his claims in Alaska. Was there more like this, up there? Maybe so, he didn't know. Would he sell this claim? No, he aimed to make more working it. Thus, as this was the most practical thing we'd seen yet, we learned what he had to tell and arranged to sail with him, look over his claims, buy a boat, prospect that vicinity. If chances weren't good, we could always work on north to the stampede area, prospecting along the way.

Considering everything, this at the time seemed our wisest move, and we did find gold, in plenty.

In July of 1897, the tiny settlement of Dyea at the base of Chilkoot Pass consisting only of the Healy-Wilson Trading Post, with two saloons and a few other log shacks. At Skagway, four miles across the head of the long sea arm called "Lynn Canal", there was but one log cabin. By a hasty order from Washington, D. C., a port of entry was declared at this point, which for the time being operated in a canvas tent serving as office and residence of the port official. Business boomed to keep him busy day and night.

An increasing stream of ships poured steadily into the port, to discharge the thousands of gold hunters and their impedimenta, together with enormous tonnage of goods and machinery some needed and much that was not. There was no pier for unloading, not even the customary long log float extending

beyond the low tide mark, which tide averaged about twenty-five feet. Instead, freight was heaped on scows, lighters, barges, rafts, or rowboats, and towed or hauled ashore. The horses, cattle, sheep and pigs were lowered to the water in slings to swim to the beach, a distance at low tide of about a half mile: a muddy incline strewn with kelp and rock weed, swarmed with men in mackinaws and hip boots, hustling goods ashore before the tide rose.

A ribbon of white tents pitched above the high tide mark contrasted sharply against the somber background of spruce along shore, where feverish crowds battled for space on which to camp. With growing piles of freight, loose stock everywhere, and often in driving snow or drenching rain, it was a pandemonium of chaotic disorder seldom seen.

An old sketch-map printed at the time by Seattle's Post Intelligencer shows the two landing spots and two main trails to Linderman Lake, with high mountains between: The Dyea route over to Sheep Camp, Crater Lake and the head of Linderman; the Skagway course up the main White Pass canyon to Summit Lake, thence down by way of Middle and Shallow lakes to Linderman, where it joined the Dyea Trail on to Lake Bennett, next beyond.

This should make clear a situation, which for a great many has always proved confusing.

During the summer of 1897 the two tent towns, Dyea and Skagway, built up rapidly aided by a sawmill which furnished rough lumber. The congestion was helped at intervals, since the gold mad mob was always straggling up over the two trails toward the Yukon, thus affording some room for the swelling flood of incoming hordes. The old Indian

trail to the Yukon from Dyea was the shortest and best marked, being but thirty miles to Linderman, with the White Pass route some ten miles longer. Formerly over the Dyea Trail, Indian packers used to charge a flat 15c a pound for loads of a hundred pounds; but now, with miners doing their own packing, competition swiftly raised it to 25c a pound, and on up to a final \$1.00 a pound, a price which for some time was the customary rate for both trails.

Moreover, the Dyea was a steep rough route for foot travel only! This was amply proved when against sourdough advice, an outfit started over it in the fall with pack stock and were snowed-in to a halt on the summit. The horses, not only high priced but hard to get, had to be saved, and they were by making and fitting to each horse a set of bear-paw snowshoes, then training the herd to travel on them back down to where bare ground still remained.

At that time horses were a necessity on the Skagway Trail, and brought high prices. Scrub stock bought in Seattle at twenty dollars a head sold readily in Skagway for \$150 to \$250 each without a pack saddle. Horseshoe nails were 25c each. Hay was \$100 the ton. Pack saddles with rawhide kyacks cost anything a seller cared to ask.

The Skagway route over the 5000-foot White Pass was new and cut through forests of virgin timber. It was strictly a horse trail which crossed many crude log bridges. The boulder-strewn pathway was full of mucky knee-deep quagmires, where some horses bogged down and had to be shot and trampled under foot, by the surging human river which stopped for nothing in the path of the insane scramble for the Yukon and riches.

Both trails were littered with cast-off dunnage, blankets, tools and whatnot, discarded by exhausted thousands who staggered onward regardless. Many did get cold feet and gave up, hastening back to the landing places anxious to ship back home. The "Keeler's Place", a notorious pawn shop in Skagway, gave them the fare to the States in exchange for anything they had left of value.

Illustrating the reverse side of this shield, the writer recalls at least one Klondiker of rare foresight. All he packed in, besides his grub and bedroll, was a huge grindstone. He laughed off ensuing jests, quips and ribald ridicule that followed him to Dawson. And well he might, for there were many axes in Dawson, but no grindstone. It was just as he had figured. He reaped a fortune at \$1.00 a grind and the customer turned the stone himself, while he, getting his laugh last, loafed comfortably nearby, watching dust and nuggets pile up.

In 1897, both landing places were typical frontier towns. There was no law, save that sketchily administered by over-worked Commissioner John U. Smith; or at times a miner's court of hastily picked bystanders whose decisions were swiftly carried out by Dawson-bound men. The most serious offense was food-cache robbery, which drew a death sentence.

Transportation was the chief stumbling block. All sorts of pack animals were pressed into service; horses, dogs, even cattle, shipped in for beef, carried loads on their backs. And still the rushing crowds increased. Still the towns grew. So swiftly was Skagway built up that in October there were rough framed stores, law offices, blacksmith shops, restaurants, and so on, hastily constructed of lumber saw-

ed on the ground. There was even a thriving newspaper, "The Skagway News", its masthead announcing it "The paper nearest the Gold fields". At first it was a dollar a copy. Someone would buy one, hit the nearest saloon, collect two-bits from all there, then mount a barrelhead to dispense the local news to all within earshot.

Gambling joints, dance halls and dives took in fortunes, for wheels were wired, card sharks numerous, and what they missed the lady gold diggers took by rolling drunks. Such shenanigans were so common that the N. W. Mounted Police later reported it was "little better than hell on earth". Sure-thing men not only worked the towns, but had campfires burning along the trails where shell games and cold deck poker for high stakes cleaned up. Cappers were everywhere, steering cheechako suckers to resorts where the lowest priced drink was four-bits. In fact, both towns were wide open, with no controls.

The Government in Washington made scant provision to check all this, except to send in a Deputy Marshal and a Deputy Collector of Customs. The latter was without tent, entry blank, or table to write on. The Marshal looked things over and joined the Skagway looters, where he did all right until he was arrested and sent down to Sitka jail.

Over in Dawson such conditions were unknown. Mounties kept strict control from the first, putting undesirables on the community wood pile to "saw wood, or freeze".

The worst of them were handed the "blue ticket" and herded south instantly, where matters were more to their liking and where most of them later joined Soapy Smith's toughs.

Still gold seekers swarmed in from all sides: up the Yukon from St. Michaels, over the glaciers and up Copper River, even up from Wrangel by way of the Stikine, Teslin, and Lewes rivers. On the Canadian side, they streamed northward along the old "Telegraph Trail", some of it on the same route later surveyed for the Alcan Highway. Many of these never reached Dawson, owing to trail mishaps, fight fatalities, cold feet, or a score of other reasons.

Among the trail hazards which delayed or blocked success, is the traditional trail grouch, caused by physical and mental strain. The tough going over the mountains often ended in dissension between partners when they reached Lake Linderman, where many parted company. It is a fact that on this lake shore where all must build boats for the following trip by water, partners sawed their finished boats into two equal parts, and even split their Yukon stoves, each being unwilling for the other to have more than belonged to him. Hardship brought out the best and worst in those who traveled these trails. It either made, or broke them. It was the strong, the patient and the courageous who won in the end.

Andrews, in his "Story of Alaska", (Caxton, 1938), writes of this great hegira, perhaps the biggest and wildest known:

"There was something magnificent in the movement of that host through the defiles of those forbidding mountains. The high spirits that gave them strength to tackle the real trials and terrors of that trail had its elements of greatness. Death lurked along the way, by flood, avalanche, a hold-up gun, wild animals, or sheer accident. Pneumonia and meningitis took their toll, yet hope lured them on ...".

TO PAGE 24

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Jap Earthquake Kills 1172

On December 21st the most violent earthquake in history rocked southern Japan. The quake caused six tidal waves that swept the coast killing 1172 persons and making 100,000 homeless. Most property damage was done by fires which broke out immediately after the first shock wave. Although the quake was far more intense than the disastrous 1923 quake, far fewer lives were taken. The 1923 quake killed 143,000 Japanese.

All of the Japanese home islands lie in an earthquake belt that stretches from the Aleutian Islands southward through Java. During the war the allied high command had seriously considered detonating large quantities of high explosives on a fault line lying a few hundred miles east of the home islands in an effort to cause an extensive quake. The plan was never carried out because it was feared tidal waves resulting from the quake might be injurious to our bases on islands to the south.

Canada's Headless Valley to be Explored

Three separate expeditions will leave within the near future to explore Canada's mysterious "Headless Valley." The Valley, lying two hundred miles northeast of Whitehorse, Y. T., has long been the subject of speculation. In the last eight years 13 trappers and traders have disappeared or been found dead under mysterious circumstances. The trappers who have been found dead have with only one exception been victims of de-

Indians believe the valley is a land of deep chasms, hot springs, geysers, and rich lode gold mines.

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They say tropical plants fed by springs cover the floor of the valley and that strange animals inhabit the place.

One of the parties is a twelve man expedition of Canadian war veterans. This expedition will be led by Tom Carolan of New Westminster. They will leave in late March and will explore the valley for six weeks. Another expedition is being organized by H. Hendrickson of Zebbalos, B. C. who will recruit veterans with commando training to enter the valley in search of gold. Mr. Hendrickson says he wants men with commando training just in case the legend is true. He refers to the legend that the valley is inhabited by head hunters. The third expedition is to be carried out by a party of United States marines who will explore the wild region in June. The motives for the third expedition are not known.



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Chicago Meeting

The Chicago Rocks and Minerals Society held the first meeting of the year at the Sauganash Field House. The speaker of the evening was Vida Latham, MD, DDS. Her subject was "Diatoms."

Dr. Latham is a prominent member of the Illinois State Microscopical Society, which she helped organize. She was also one of the organizers of the Chicago Academy of Sciences and the author of several medical textbooks.

She came to the meeting armed with four different types of microscopes, a large and choice collection of microphotographs of diatoms, some bottles of different colored diatomaceous earth, and best of all, some of her most valuable and irreplaceable slides, showing different forms of diatoms.

Dr. Latham spoke fluently from a vast knowledge gleaned through years of research on her subject. The audience enjoyed every moment of it and the question period which followed. All were amazed to learn of the great number of commercial uses of the diatom.

George C. Anderson, Pres.

Oil Drilling in Nebraska

The Carter Oil Company is planning to drill a number of new wells in south-eastern Nebraska. Seisograph work is now under way and drilling should commence before spring. Other companies are currently investigating oil possibilities in western Nebraska. Test wells have been drilled but the results will not be made public for some time.

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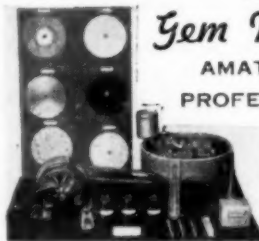
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ALASKAN TRAILS OF '98

From page 17

Many a saga, many an epic has told the story of these eventful days, and still are being sung and written. However, perhaps the complete history will rest eternally in those lonely Klondike graves. Many tales of both tragedy and humor still are told, among which is the one about Swiftwater Bill and his inamorata of the moment. It occurred right in Dawson, where Swiftwater tended bar. It seems the lady, whose name was NOT "Lou", was very fond of eggs for breakfast; so, after a terrific spat one night, Swiftwater, to spite the damsel and to ruin her morning meal, bought up every egg in town and smashed them. The story goes though, perhaps he only hid them, to win her back later on. Anyway, Bill was

no hero. His sobriquet was earned by his fear to run White Horse rapids on his way to Dawson and he never outlived it. However, true or false, the tale typifies the spirit of those times.

During the fall of 1897, Dawson was hit with a fear of food shortage. Incoming prospectors arrived with scanty supplies. Miners began to buy food to cache or even to hold and sell later at higher prices. At any rate, the food lack was so serious that an appeal was sent to Washington for help. This stirred up Congress which approved an appropriation of \$200,000 for relief. Dr. Sheldon Jackson was commissioned to secure 500 reindeer from Norway, sledge-deer, to haul food supplies to Dawson, but to be used for food if necessary. Sledges and drivers were to be shipped with the

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14"	3	11.75	10.00
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reindeer.

Thus 539 reindeer were shipped to New York, thence to Seattle and up to Alaska, finally to be landed at Haines Mission some fifteen miles below Skagway on the west side of Lynn Canal. It was then learned that the Dawson food shortage was not so serious as reported and the herd was held to await further instructions. They finally were driven by way of Dawson down the Yukon to Teller Mission near Ft. Gibbon, to augment the herd brought from Siberia for the Eskimos in 1892.

When winter set in much trail hardship passed. With streams and quagmires bridged by ice and snow, pack stock made better time and more easily. A wagon road was being built up Skagway River, and with Dyea & Dawson Transport Co. competing for freight, rates by spring in 1898 fell to 4c a pound from Dyea to Scales and 13c to Lake Bennett. Also, in 1898, the Chilkoot Rail & Transport built a tram up the White Pass, though its haulage rates at first were very high.

It was during the '98 spring storms, when the disastrous avalanche took its death toll. Gales heaped snow in huge drifts and into mighty cornices jutting from high cliffs in the mountains. When sun hit these cornices they settled on April 3rd and sent a mighty snow slide down the Pass. It engulfed miners who had started to travel when the gale ceased. Fifty-six bodies were recovered near Scales, most of them dug from the snow-ice, with more found after the snow melted. Sourdoughs, still living, tell stories describing the horrors of that avalanche.

All winter the stampede continued, for despite the Spanish War the rush to the Klondike gained volume. The news by this time was world wide in extent. In fact, the

Customs Office at Skagway recorded 5,000 miners that landed there in February alone. A count that spring on both passes totaled 3,700 dead pack horses.

After the Yukon ice went out and steamers brought to Seattle the bullion recovered during the previous year, these millions served to stimulate the rush northward. A few examples show why: the St. Paul docked with six million, the Roanoke had one and a half million, and when the Charles Nelson, the 13th ship, brought several millions more it can be understood how the gold craze increased. This does not include the large amounts brought by miners which was never declared.

After the spring breakup on the upper Yukon, scores of new river boats plowed its waters, many of them were hauled in sections across the mountains and assembled on Linderman and Bennett. Also more and bigger steamers appeared at Dyea and Skagway from Seattle, with a number that came around Cape Horn. During 1898, in fact, there were thirty-two transportation companies doing business on the Yukon, with sixty steamboats, eight tugs and tow boats, and twenty barges.

The Klondike River with its numerous golden creeks was a very limited area, 20,000 miners were reported in Dawson town, while other thousands strung out along both mountain trails and more were always coming. Placer miners began to spread out over surrounding country, the Copper River claiming a large share. Some pioneered the rich field of Atlin Lake, while Tanana River and Nome Beach attracted others. Some even traveled north of the Arctic Circle to the Kobuk and Noatak and struggled up the Koyukuk and Chandalar rivers, to Beetles and Coldfoot.

The Klondike area in 1898 produced an estimated \$200,000,000, but the amount spent for outfit, grub, fares, and mining costs is said to have been more than one billion dollars. The luckiest Klondiker was Alex MacDonald, with a poke of five million which won him the title of "King of the Klondike". It was the discoveries made in Alaska in 1898 that convinced Congress that its purchase was no mistake, consequently they authorized construction of Territorial railways. Also, the White Pass & Yukon R. R. was financed in England that year and surveyed a right-of-way from Skagway to White Horse, laying its first mile of track out of Skagway by July 2, '98. It took two years to complete, for its last mile was down on July 29, 1900.

No record of the Klondike gold rush can be complete lacking some mention at least of the notorious "Soapy Smith" bandit. His real name is said to have been Randolph Jefferson Smith, but his sobriquet was tacked on years before he hit Skagway, due to his specialty of selling cakes of soap supposedly wrapped in ten and twenty dollar bills.

The Alaska career of this underworld con artist was vicious and bloody, but fortunately brief. He actually ruled Skagway while he lived. Outwardly he was genial and well dressed, spent with lavish ringed hand, and threw largess where it did the most good — for "Soapy." His headquarters were on Sixth Avenue, merely a front, for after organizing the vicious element in town he gave them all the dirty work and confined his labors to bossing the gang.

His gambling houses and bars ran every type of device from wired wheels to loaded dice and cold-deck poker and faro. His shell-

games covered both Trails, and when these didn't win his henchmen used common thuggery. Vigilance committees warned him to leave, but couldn't back up the order and he went merrily on his way.

The pay-off came in July when a Dawson miner, Stewart, hit town with a bulging poke. In a "Soapy" saloon the poke was hefted, passed admiringly around — and disappeared. Stewart's howl got him nowhere until he went to Frank Reid, said to be the one man Soapy really feared. Reid called a miners' meeting that met on the long pier, as Reid guarded the shore end. Soapy heard of it, grabbed a rifle and went to the pier. Reid saw him coming, ordered him to halt and when Soapy started to raise his rifle, shot him through the heart. Dead on his feet, Soap's finger jerked the trigger of the half-raised gun and the bullet hit Reid in the abdomen. He fell seriously wounded, and later died. At this time citizens got busy and cleaned up Skagway, handing over the toughs to Deputy Marshall Tanner, recently appointed by U. S. Commissioner Sehlbrede.

So ended Alaska lawlessness. Ever since, as the writer can testify the Territory has been one of the most law abiding of Uncle Sam's possessions. A remarkable statement, considering the fact that bureaucratic rule, the powerful fishing and mining industries, and the steamship monopoly, all conspire to block statehood in order to retain the annual millions they mulch from Alaska. Cannery labor comes each year from the States, but wages and union dues are paid in the States.

Before the late war, the salmon industry yielded an annual fifty-five millions. Other food fish, in-

cluding halibut and herring brought a lesser sum. Gold and platinum mining yielded twenty millions, and there are other ores mined.

Amygdules

Most agate nodules that are found in volcanic formations are the result of the filling of "amygdules" with layered silica. "Amygdule" is the tongue twisting name for a lava cavity formed by bubbles of steam and other gas present at the time of solidification. The name "amygdule" is derived from the Greek name "amygdalon" meaning almond shaped.

All lavas contain both silica and alkali. Percolation of sub-surface water dissolves the alkalies first and then the silica. The silica is in most cases deposited in the cavities. This doesn't always take place at a uniform rate and as a result the color and banding of the agates formed may vary considerably. The color of the agate may be due to physical or chemical causes or both. Molecular arrangement can cause considerable variation in color. Different chemicals that precipitate out in the cavities may oxidize giving rise to spectacular inclusions.

Mineral Quiz

By Jerome Eisenberg

What are the correct names for the following minerals?

1. PLUMBAGO
2. ANTIMONITE
3. GALENITE
4. CALC SPAR
5. COPPER PYRITES
6. MISPICKEL
7. TIN-STONE
8. LAPIS LAZULI
9. PERIDOT
10. ROCK SALT
11. FLOUR SPAR
12. SPATHIC IRON
13. PEACOCK ORE
14. HORN SILVER
15. ZINC-SPINEL
16. CHESSYLITE
17. ORTHITE
18. FIBROLITE
19. PISTACITE
20. TRIPHANE

Texas Mineral Show

The Mineral Society of Texas will sponsor a mineral show in San Antonio April 5th and 6th, at the Plaza Hotel. The Society invites any dealer who would like to come and bring a display. Dealers wishing to attend this show should write to Mrs. Edith Owens, Sec'y-Treas., 380 South Sixth St., Honey Grove, Texas.

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Mineral Location

By Jerome M. Eisenberg

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Although this is primarily a fossil locality a few interesting minerals have been found here. The rock is a glauconitic marl (Navesink formation), which weathers easily, thus making the removal of the minerals quite simple.

Vivianite occurs here in excellent monoclinic crystals from 1/16 inch to one inch in length. They are usually in stellate groups and occasionally a twinned crystal is found.

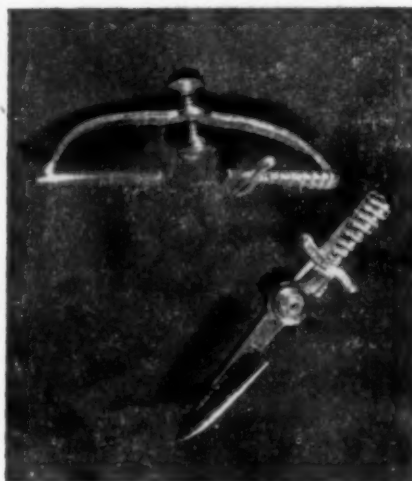
Ranging in color from a light, almost colorless, green to a grass green, fading on exposure to light to an indigo blue, a crystal is strongly pleochroic when darkened in color by exposure, changing from blue to green when revolved around its vertical crystallographic axis. This mineral is usually found in the casts of belemnites, and as a crystalline coating on the fossil shells. Occasionally it may completely replace a belemnite. Upon weathering it becomes earthy.

Fibrous radiating aragonite occurs replacing the belemnites, sometimes in association with the vivianite.

Glauconite is the main constituent of the marl, occurring with limonite in the weathered material.

These minerals are found in a bank by the side of a road junction about 500 to 1000 feet east of the Mullica Hill freight station.

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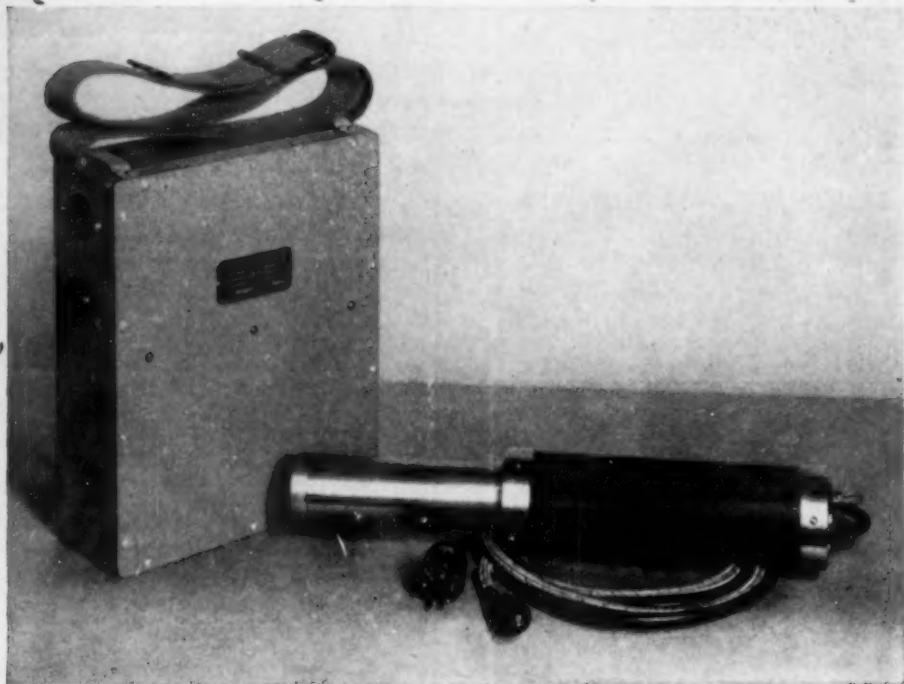
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